Application No.: A.19-08-
Exhibit No.: SCE-04, Vol. 1
Witnesses: D. Daigler

SOUTHERN CALIFORNIA EDISON®

An *EDISON INTERNATIONAL*® Company

(U 338-E)

2021 General Rate Case

Business Continuation

Before the

Public Utilities Commission of the State of California

Rosemead, California
August 30, 2019

SCE-04, Vol. 1: Business Continuation

Table Of Contents

SCE-04, Vol. 1: Business Continuation

Table Of Contents (Continued)

SCE-04, Vol. 1: Business Continuation

Table Of Contents (Continued)

I.

INTRODUCTION

A. Content and Organization of Volume

As one of the nation's largest electric utilities, Southern California Edison (SCE) is committed to keeping electricity safe, reliable, affordable and clean. This commitment requires a robust business continuation program that supports SCE's critical business processes and safely manages emergency planning and response operations that minimize service disruptions and mitigate safety, reliability and financial consequences. This exhibit presents SCE's forecast of O&M expenses for Test Year 2021 and capital expenditures from 2019 to 2023 for the Business Continuation Business Plan Element (BPE).

Catastrophic emergencies like earthquakes can happen without warning and SCE must be proactive to effectively prepare for these types of emergencies. The Business Continuation BPE enhances SCE's emergency response capabilities through programs and activities that identify hazards, perform mitigations, create contingency and response plans and train our response teams. SCE regularly partners with local, county, state and federal government agencies, community leaders and members of the public, before during and after emergencies to foster collaboration with local jurisdictions, understand their unique restoration challenges, and enhance emergency planning and response overall.

The Business Continuation BPE includes two work activities: Planning, Continuity, Governance and All Hazards Assessment, Mitigation and Analytics. This volume summarizes the key drivers, scope of work, and regulatory mandates impacting SCE's O&M and capital forecasts. This volume should be viewed in tandem with SCE-04, Vol. 2, Emergency Management and SCE-04, Vol. 5. Wildfire Mitigation as the Business Continuation BPE provides the foundational emergency planning for those company-wide resiliency functions.

B. Summary of O&M and Capital Request

This volume (1) compares O&M and capital amounts authorized in the 2018 General Rate Case (GRC) to recorded amounts in 2018, (2) analyzes the 2021 Test Year O&M labor and non-labor forecast relative to historical spending and (3) describes planned capital projects supporting the Business Continuation BPE**.**

Figure I-1
Business Continuation O&M Expenses
(Total Company Constant $Millions)

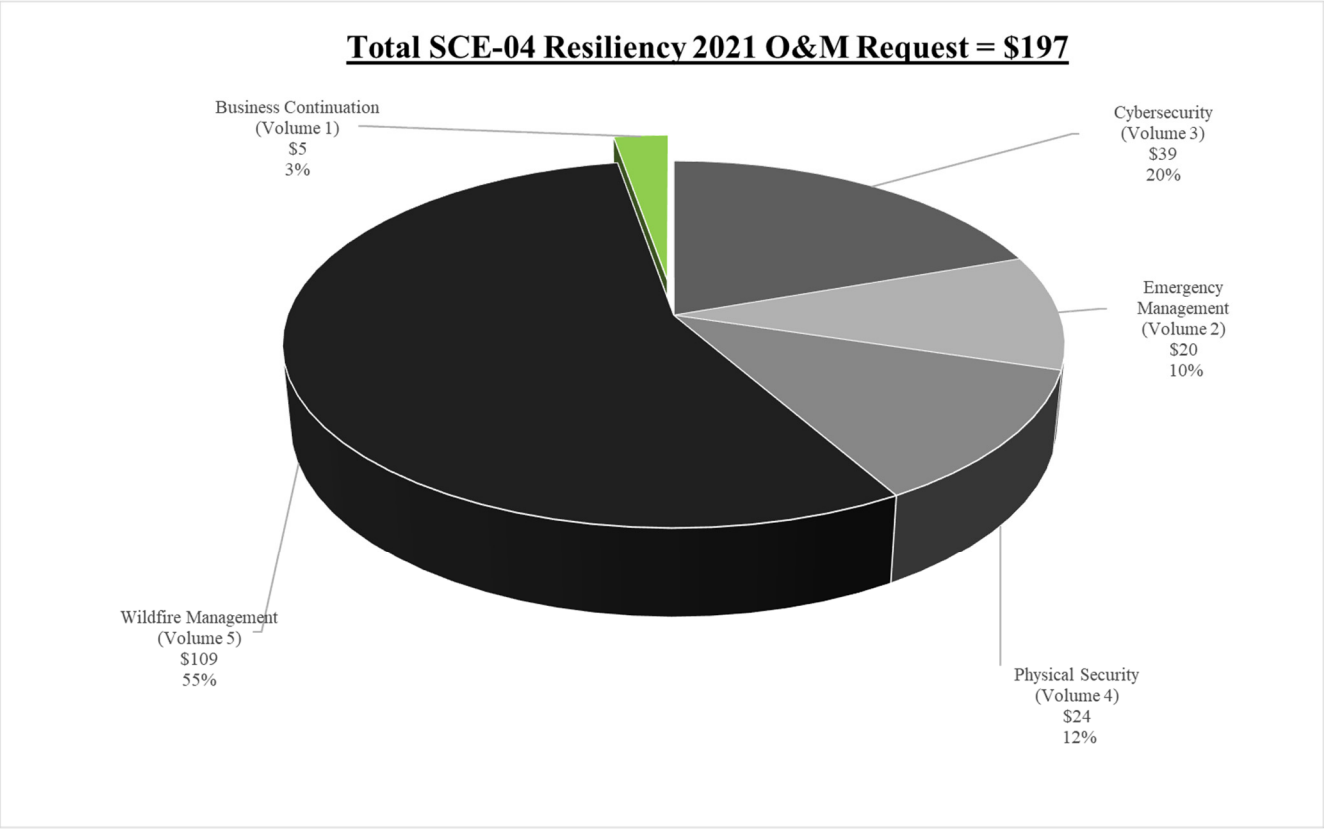


Table I-1
Resiliency O&M Expenses
(Constant 2018$ Millions)

	2021 Total
Business Continuation (Volume 1)	$5.3
Emergency Management (Volume 2)	$19.9
Cybersecurity (Volume 3)	$38.6
Physical Security (Volume 4)	$23.6
Wildfire Management (Volume 5)	$109.3
Grand Total	**$196.7**

SCE's forecasts for the Business Continuation BPE are $5.3 million (Constant 2018 dollars) in O&M expenses for Test Year 2021 and $222.3 million in capital expenditures from 2019-2023. These forecasts support SCE's activities to assess and understand the hazards and threats impacting its service

territory, make investments to reduce those impacts, and develop effective training and exercise plans for SCE's Incident Management Teams (IMTs). SCE has also developed specific programs to mitigate the effects of earthquakes, climate change, and severe weather. These programs follow the recommendations and best practices of federal and state government agency guidance, including the Safety Enforcement Division's (SED) recommendations from its Report on SCE's Risk Assessment and Mitigation Phase (RAMP) showing.

Figure I-2
Business Continuation Capital Expenditures 2019 – 2023
(Total Company Nominal $000)

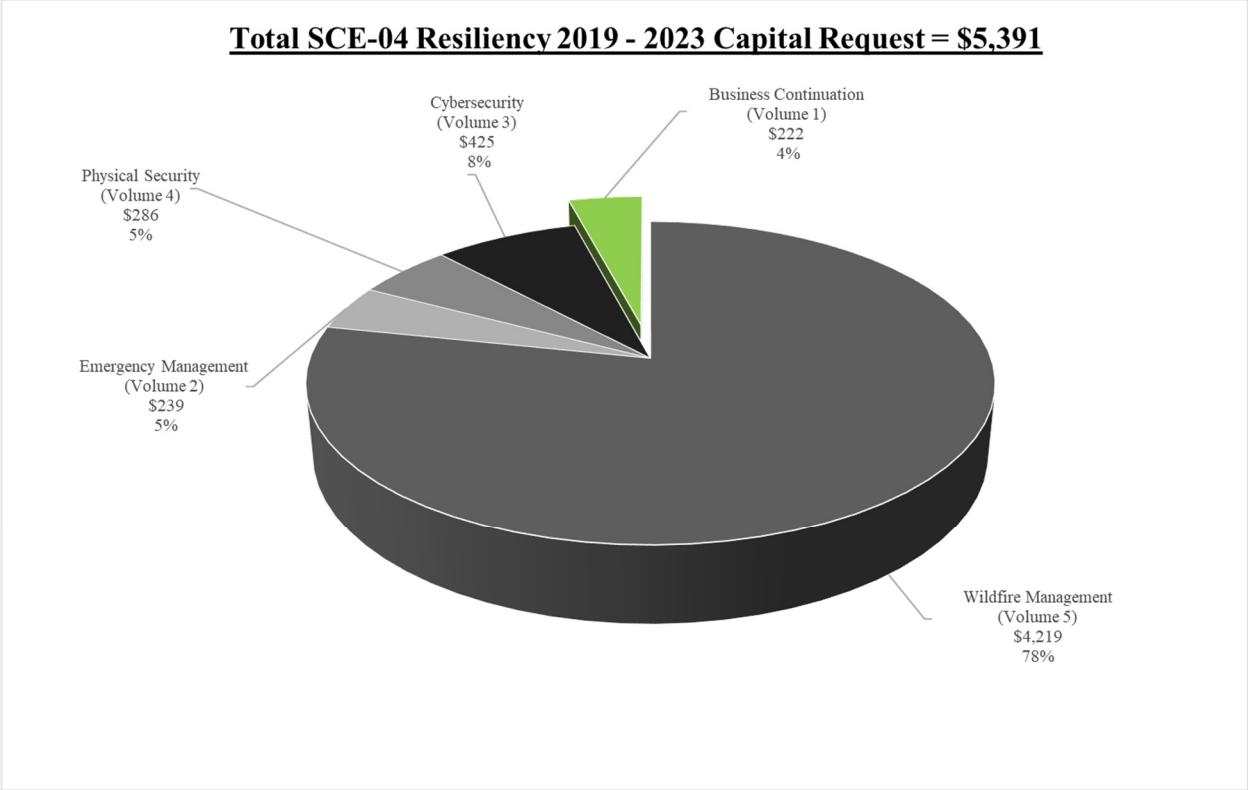
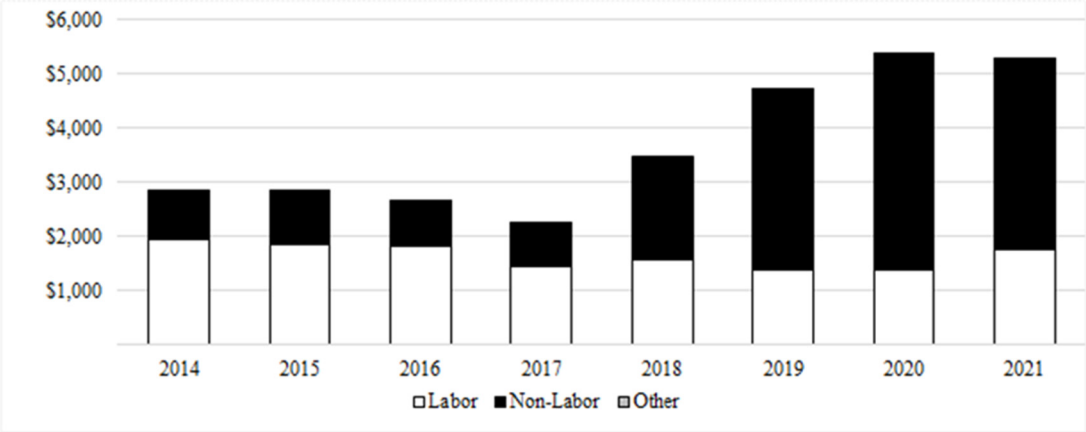


Table I-2
Resiliency Capital Expenditures
(Nominal $Millions)

	2019 -2023 Total
Business Continuation (Volume 1)	$222
Emergency Management (Volume 2)	$239
Cybersecurity (Volume 3)	$425
Physical Security (Volume 4)	$286
Wildfire Management (Volume 5)	$4,219
Grand Total	**$5,391**

Figure I-3 shows SCE's O&M recorded costs from 2014 to 2018 and forecasts for the Business Continuation BPE, including $5.3 million (Constant 2018 dollars) in O&M expenses for Test Year 2021.

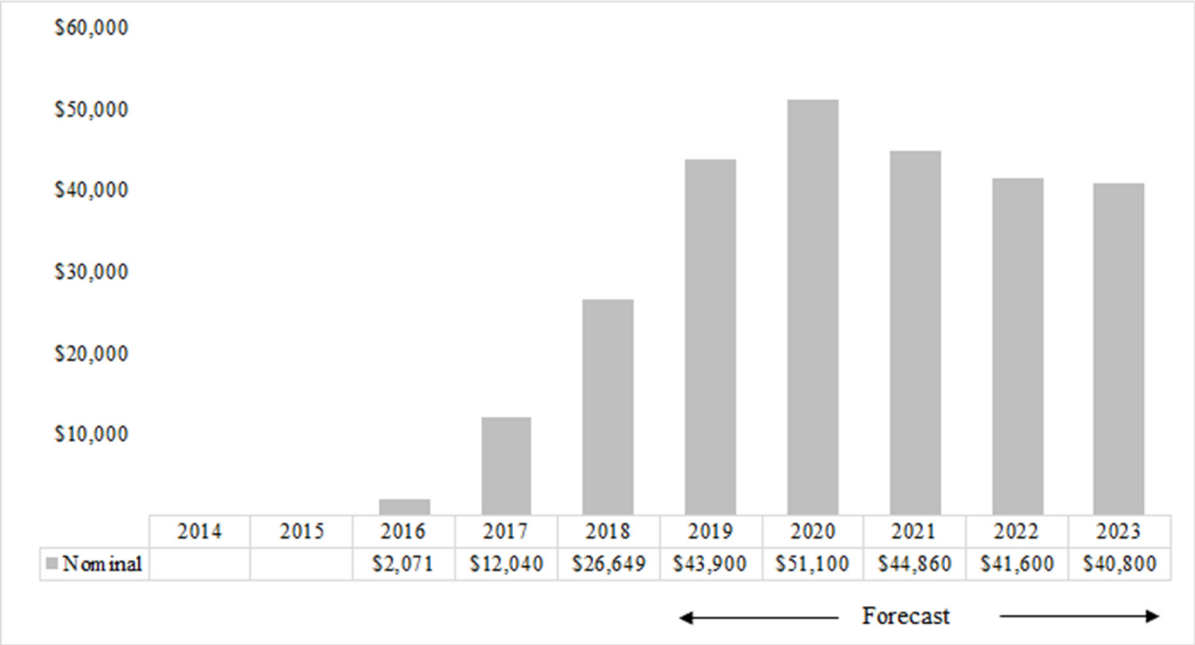
Figure I-3
Business Continuation O&M Expenses
(Constant $Million)



	Recorded					Forecast		
	2014	2015	2016	2017	2018	2019	2020	2021
Labor	$1,932	$1,856	$1,808	$1,436	$1,560	$1,389	$1,384	$1,755
Non-Labor	$899	$991	$842	$830	$1,891	$3,338	$3,992	$3,542
Other					$0			
Total Expenses	**$2,831**	**$2,848**	**$2,650**	**$2,266**	**$3,452**	**$4,728**	**$5,376**	**$5,297**
Ratio of Labor to Total	68%	65%	68%	63%	45%	29%	26%	33%

Figure I-4 shows historic expenditures from 2014 to 2018 and the capital forecast of $222 million from 2019 to 2023 to support Business Continuation activities.

Figure I-4
Business Continuation Capital Expenditures 2019-2023
(Nominal $000)



II.

BUSINESS CONTINUATION

A. Overview

The Business Continuation BPE is comprised of two work activities. (1) Planning, Continuity and Governance and (2) All-Hazards Assessment, Mitigation and Analytics.

The Planning, Continuity and Governance work activity generates the Business Impact Analysis (BIA) that helps to inform investment strategies and establishes the priorities for contingency and emergency plans used by the Company's Business Continuity Teams. Business Continuity Teams are organization specific teams that implement emergency planning functions based on the results of the BIA to increase continuity of operations and reduce the impact of emergencies on critical business processes, applications and systems. The BIA also establishes the priorities for the Information Technology/Disaster Recovery (IT/DR) processes and provides governance over these programs, including compliance with NERC CIP 008 (Incident Response) and NERC CIP 009 (Disaster Recovery) requirements.

To standardize emergency planning and response operations, SCE employs an all hazards emergency planning approach covering all manner of emergencies and scenarios. SCE creates detailed and specialized response plans for catastrophic scenarios having the highest impact on the service territory and requiring focused level of training for the Business Continuity teams and IMTs, including plans for earthquakes, wildfires, physical and cyber security breaches, and storm events. These plans are collaboratively developed using Federal Emergency Management Agency (FEMA) guidelines[1] in partnership with internal stakeholders. These plans guide SCE's IMTs and their response operations during emergencies to support efficient restoration of power.[2] SCE trains, exercises and qualifies these IMT and Business Continuity teams using these emergency and contingency plans. In 2015, SCE co-founded the Southern California Critical Lifelines Working Group that meets quarterly to provide planning integration with our critical infrastructure partners and local, county, state, and municipal Emergency Managers.

---

[1] Federal Emergency Management Agency (FEMA) guidelines include the National Response Framework and Comprehensive Preparedness Guide 101 (CPG-101) which can be accessed on the FEMA website at https://www.fema.gov/media-library.

[2] Further detail regarding SCE's IMTs can be found in SCE-04,Vol. 2, Emergency Management.

The Governance function includes compliance oversight of plans and programs addressing regulatory requirements, including NERC and Commission standards, and responses to regulatory inquiries and policy management. This work activity also covers budget oversight, internal metrics and standards creation, and Business Resiliency's internal corrective action program. In 2013, SCE instituted an innovative governance model whereby representatives from each organizational unit collaborate on and execute Business Resiliency initiatives both within their respective organizations and enterprise wide. This model fosters collaboration and compliance by engaging all SCE stakeholders simultaneously, identifying common resiliency gaps and calibrating best practices across the company.

The second work activity under the Business Continuation BPE is All Hazards Assessment, Mitigation, and Analytics. This activity focuses on assessing and analyzing the potential impact of hazards and identifying mitigation strategies, like system hardening or changes to business processes, before they occur. Specific activities include the assessment of natural hazards (e.g., earthquakes, severe weather) and man-made hazards (e.g., physical security breaches) and identification of mitigations for those hazards (e.g., seismic retrofit of buildings and design standards and planning changes). The All Hazards Assessment, Mitigation, and Analytics work activity is presently divided into four programs: (1) Seismic Assessment and Mitigation, (2) Climate Adaptation and Severe Weather, (3) Targeted Hazard Analysis, and (4) Analytics and Technology Integration.

1. Risk Factors, Safety, Reliability and Connection with RAMP

Electricity is essential to every aspect of modern life, and the federal government has deemed electric utilities a critical segment of the national infrastructure with far reaching homeland security and economic implications. In 2011, Presidential Policy Directive/PPD:8: National Preparedness was instituted and defined how the nation should both prepare for and respond to a wide range of natural hazards such as earthquakes, wildfires, severe weather conditions and environmental changes. This also includes other business disruptions, such as physical intrusions, cybersecurity breaches and sabotage. SCE has focused on developing capabilities to address these types of vulnerabilities and bolster the ability to safely deliver reliable and clean power.

This volume contains activities related to addressing Building Safety (seismic risk) and Climate Change risks, as described in SCE's 2018 Risk Assessment Mitigation Phase (RAMP) report. Table II-3 below specifies one control, Seismic Building Safety Program (C1), relating to the Building Safety risk, and one mitigation, Climate Adaptation and Severe Weather Program (M1), relating to the Climate Change risk. Descriptions of these activities follows below under each GRC Activity.

Table II-3
Business Continuation RAMP Controls & Mitigation Activities

GRC Activity	RAMP Control / Mitigation Name	RAMP ID	Risk Addressed
All Hazards Assessment, Mitigation & Analytics	Seismic Building Safety Program	C1	Building Safety
	Climate Adpt & Svr Wthr	M1	Climate Change

a) SED / Intervenor Comments

SCE discusses Climate Change Adaptation risks and Seismic risks to buildings, in the RAMP Report. In its comments, SED recommended SCE provide more specific information on seismic risks associated with T&D assets,[3] and submit a proposed seismic assessment and accompanying proposed mitigation plan for infrastructure in high risk areas as designated on the Southern California Earthquake Center risk map in the 2021 GRC.[4] In relation to Climate Change risk, SED recommended the following actions be taken:

1. Conduct vulnerability assessments per the direction of the DOE guidance and the CPUC guidance to fully understand the impacts that climate change will have on the grid and the customers.
2. Prepare resiliency plans that address those vulnerabilities providing several options and an analysis of the costs and long-term benefits of those actions.
3. Provide 3-5 year investment plans based on the resilience plans to begin investing in long term adaptation to the anticipated impacts of climate change.[5]

As the focus of the RAMP filing was on Safety Risks and secondarily on Reliability, Seismic Risk was not discussed as a standalone risk but was identified as part of the building safety and hydro risk chapters. The SED comments to SCE's RAMP Report requested a comprehensive assessment of Seismic Risk to all SCE facilities, including electric infrastructure, as part of this rate case. In response, SCE notes that its Seismic Assessment and Mitigation Program was initiated in 2015

[3] See SED's "A Regulatory Review of the Southern California Edison's Risk Assessment Mitigation Phase Report for the Test Case 2021 General Rate Case," dated May 24, 2019, I18-11-006, p. 34.

[4] See SED's "A Regulatory Review of the Southern California Edison's Risk Assessment Mitigation Phase Report for the Test Case 2021 General Rate Case," dated May 24, 2019, I18-11-006, p. 54.

[5] See SED's "A Regulatory Review of the Southern California Edison's Risk Assessment Mitigation Phase Report for the Test Case 2021 General Rate Case," dated May 24, 2019, I18-11-006, p. 59.

and requested and authorized as part of the 2018 GRC. In accordance with SED's recommendation, this volume includes activities associated with this ongoing program's costs, scope of work and impacts related to seismic risk across SCE, which includes Transmission and Distribution and Generation infrastructure consistent and building upon its showing in the 2018 GRC.

In response to the SED's recommendations on addressing climate change adaptation, the Commission's Climate Change Adaptation Order Instituting Rulemaking (OIR) (R.18-04-019) is currently underway and will provide a separate review of climate resilience. As SCE is an active party in that OIR, substantive matters related to climate resilience shall continue to be developed through the stakeholder process of that OIR. However, this volume includes forecasts from 2019-2023 for ongoing climate change adaptation analysis and planning activities. These forecasts do not include any additional costs and/or changes that may be required to fulfill the SED's request and the OIR requirements.

2. Regulatory Background/Policies Driving SCE's Request

Business Continuation BPE activities are driven by several regulatory policies and standards. The Commission's General Order 166 (entitled Standards for Operation, Reliability and Safety during Emergencies and Disasters) establishes standards that electric utilities must follow when developing plans to respond and recover from emergencies. The stated purpose of these standards is minimizing damages and impacts to the public resulting from electric system failures, major outages due to storms, and hazards posed by compromised electric distribution facilities.

California Public Utility Code § 768.6 establishes additional standards for investor owned utilities when developing disaster and emergency preparedness plans and programs. These standards focus on engagement and input from public agencies, including establishing points-of-contact with cities and counties within SCE's service territory and obtaining input from those contacts on emergency plans and programs that could impact their regions.

The Commission's Electrical Standards and Reliability Branch (ESRB) recently issued standards under Resolution 8 for notifications to public safety agencies and customers in the event pro-active de-energization is necessary due to an existing or impending wildfire. In a series of recent Decisions (D. 12-04-024 and D.19-05-042), the Commission adopted reporting requirements for all investor owned utilities with regard to pro-active de-energization, including meeting with local communities that may be impacted by a future de-energization event, transmitting customer notifications prior to a de-energization event, notifying SED as soon as practicable after a decision to de-energize

facilities with an explanation of de-energization processes. SCE's hazard-specific Wildfire Response Plan outlines the actions required by the IMTs leading up to and during wildfires and includes reporting pursuant to the above-referenced standards and requirements.

California Senate Bill 901 (SB 901) was also enacted in 2018 and requires electric utilities to prepare and submit wildfire mitigation plans (WMPs) that describe the utilities' plans to prevent, combat, and respond to wildfires affecting their service territories. Through a proceeding it opened on Oct. 25, 2018 (R.18-10-007), the CPUC reviewed the utilities' initial 2019 WMPs. SCE's 2019 WMP was approved by the Commission in D.19-05-038.

Business Continuation BPE activities also address compliance with the North American Electric Reliability Corporation's Critical Infrastructure Protection (NERC-CIP) standards for cybersecurity threats, California's seismic regulations and codes for infrastructure and facilities, and Federal Energy Regulatory Commission (FERC), and Western Electricity Coordinating Council (WECC) standards for grid resiliency and service disruption avoidance.

3. Comparison of Authorized 2018 to Recorded

In the 2018 GRC Decision, SCE was authorized funds related to Business Continuation, SCE-04, Vol. 1 and Emergency Management, SCE-04, Vol. 2 in connection with SCE's labor and non-labor cost forecasts for SCE's Business Resiliency Department. Table II-4 below summarizes authorized versus recorded costs for both Business Continuation and Emergency Management activities during 2018.

Table II-4[6]
Business Resiliency Department 2018 O&M Expenses – Authorized versus Recorded

Labor/Non-labor	2018 Authorized (2018 $s)	2018 Recorded
Labor	$ 4,045	$ 4,204
Non-Labor	$ 4,464	$ 3,484
Total	$ 8,510	$ 7,688

[6] Refer to WP SCE-07, Vol.1 Authorized vs Recorded

As shown in Table II-4, SCE recorded $0.8 million less than authorized in 2018. The variance is largely as a result of staff added to SCE's Business Resiliency Department which resulted in a decrease in non-labor costs associated with outside consultants exceeding the additional labor expense.

Table II-5 below provides a more detailed breakdown splitting the authorized and recorded costs between Business Continuation and Emergency Management activities.

Table II-5
Business Continuation & Emergency Management
O&M Expenses for 2018 – Authorized versus Recorded by Volume
[Previously Authorized under Business Resiliency Department]

Labor/Non-Labor	Volume	2018 Authorized	2018 Recorded
Labor	Business Continuation	$1,985	$1,387
Labor	Emergency Management	$2,060	$2,817
Labor Subtotal		**$4,045**	**4,204**
Non-Labor	Business Continuation	$2,172	$1,886
Non-Labor	Emergency Management	$2,292	$1,598
Non-Labor Subtotal		**$4,464**	**$3,484**
Total		**$8,510**	**$7,688**

As seen in Table II-5, the variance between authorized and recorded amounts for labor costs (namely, $0.6 million less than authorized for Business Continuation and $0.8 million greater than authorized for Emergency Management) arose from the reassignment of employees to Emergency Management activities for enhanced emergency response and recovery operations.

This increase in costs for Emergency Management was also due to the transfer of three meteorologists (formerly in Energy Procurement & Management – EP&M) and the hiring of three additional staff members for training and exercises to reduce reliance on outside contractors. The meteorologist team was transferred from EP&M to Emergency Management to integrate weather forecasting capabilities within Emergency Management and provide IMTs with enhanced, real time and focused situational awareness data. Resources were shifted between Business Continuation and Emergency Management to better align job duties and responsibility requirements with organizational goals and objectives. The increase in training and exercise staff was to reduce reliance on external contractors (and associated costs) and enhance internal subject matter expertise. This resulted in higher labor costs and lower non-labor costs in 2018 as compared to 2018 recorded costs.

B. Planning, Continuity, and Governance

1. Work Description

The primary objectives of SCE's Planning, Continuity & Governance activities are to (1) standardize and strengthen the development of new and existing emergency and contingency plans, (2) quickly establish continuity of operations as soon as possible following an emergency, and (3) execute governance over required compliance programs related to emergency management and response and recovery. Activities include execution of an annual Business Impact Analysis (BIA) in each OU and across the enterprise, creation and maintenance of emergency and continuity plans executed by IMTs during response and recovery operations, as detailed in SCE-04, Vol. 2 in compliance reporting.

Team members establish and manage the development of plans for emergency response, business continuity, disaster recovery and have governance and oversight of these programs to track the effectiveness and compliance of the work. This work activity also manages Business Resiliency department finances, tracks and reports on performance metrics, and implements continuous improvement initiatives enhancing SCE's safe and reliable delivery of power.

a) Standardize and Strengthen Emergency and Contingency Plans

Emergency planning requires coordination and collaboration with all impacted stakeholders before an emergency occurs as well as alignment. SCE accomplishes this through regular outreach with stakeholders in accordance with California Public Utility Code § 768.6 and foster relationships that can be leveraged for a more coordinated response during an emergency. SCE's emergency response plans align with the National Incident Management System (NIMS) and the Standardized Emergency Management System planning frameworks used by state and local agencies to better address the specific needs of the communities SCE serves.

b) Continuity Planning

Annually, SCE produces a Business Impact Analysis (BIA) identifying and prioritizing the criticality of each process, application and system supporting SCE's delivery of power to its customers, including assessments of impacts if those elements are disrupted. The BIA process involves each OU and allows the functional prioritization of business continuity and disaster recovery plans of critical IT applications and assets to manage the continuity of operations during an emergency. The BIA process works in conjunction with an established governance model aligning IT/DR critical application functions with existing continuity plans, processes and procedures. This governance model prioritizes, strengthens and supports redundancy of critical applications across the company.

Given the particularly critical nature of IT systems and applications to grid reliability, SCE will be supplementing the Business Continuity BPE with additional staff working within IT and focused on addressing the resiliency of critical applications and systems during emergency events. The additional staff will be responsible for the creation, training and exercising of emergency plans, processes and procedures associated with these critical IT specific systems and applications.

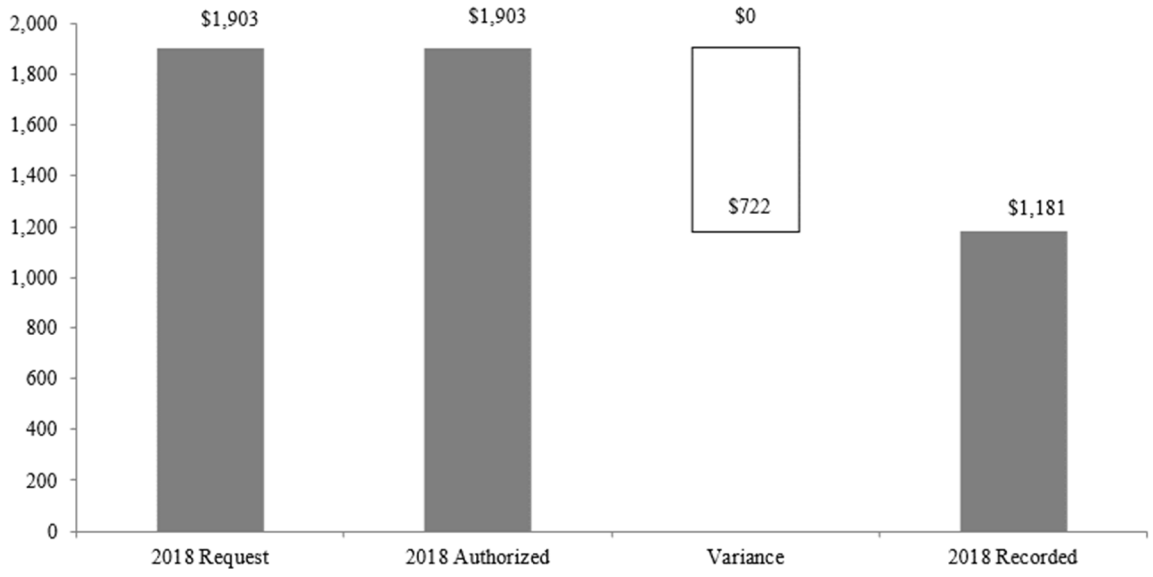
c) Governance

The Governance function helps ensure alignment to corporate and department strategic and near-term objectives which include; financial planning and performance, program metrics and reporting, compliance implementation and continuous improvement. Governance also ensures the appropriate level of engagement with stakeholders that play a crucial role in managing emergencies and execution of lessons learned, thereby enhancing SCE's ability to prepare for and respond to all types of emergencies. The Governance function also implements controls to comply with regulatory mandates such as NERC CIP standards for Incident Response & Recovery of critical systems related to the Bulk Electric System.

2. Need for Activity

SCE's Planning, Continuity and Governance activities are intended to mitigate the risks and associated consequences from both natural and man-made hazards that can cause extended outages and other service disruptions and negatively impact the customers and communities SCE serves. Therefore, SCE's ability to maintain continuity of business operations and successfully respond to and recover from emergencies is critical to safely deliver reliable, clean power. This requires coordinated planning efforts to identify gaps and create redundancy while continuously improving response plans before an emergency occurs. A robust emergency planning capability allows the Company to address disruptions before they occur by organizing a coordinated response, engaging and communicating with internal and external stakeholders and customers, collaboratively managing shared resources, and prioritizing mitigation and response efforts

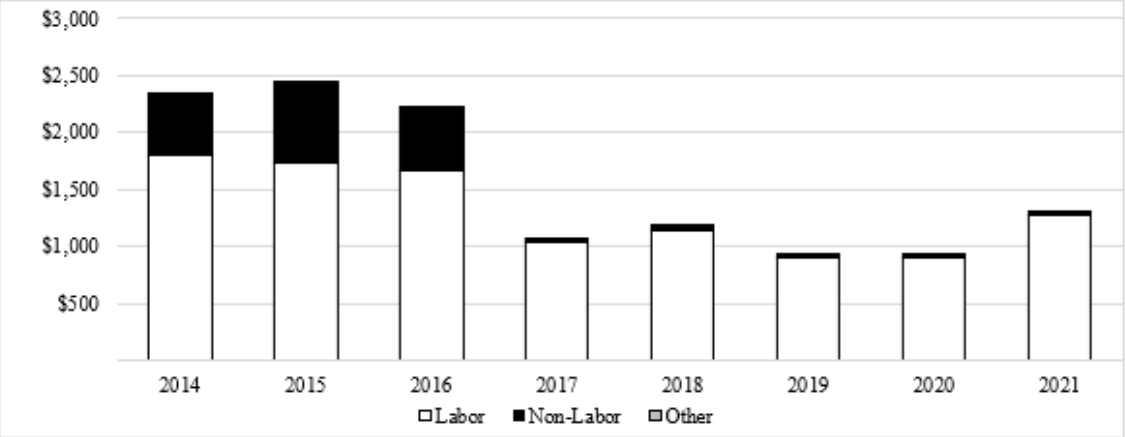
Figure II-5
Planning, Continuity & Governance
O&M Expenses for 2018 - Authorized versus Recorded
(Total Company Constant 2018 $000)



3. Comparison of Authorized 2018 to Recorded

As represented in Figure II-6, the 2018 GRC decision authorized $1.9 million for the Planning, Continuity and Governance activity. SCE's recorded $1.2 million in 2018 due to reassignment of employees from this activity to Emergency Management activities for enhanced emergency response and recovery operations during emergencies.

Figure II-6
Planning, Continuity & Governance (O&M)
(Recorded 2014-2018/Forecast 2019-2021)
(Constant 2018 $000)



	Recorded					Forecast		
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Labor	$1,806	$1,726	$1,664	$1,032	$1,135	$897	$892	$1,276
Non-Labor	$536	$716	$564	$32	$46	$38	$38	$38
Other								
Total Expenses	**$2,341**	**$2,442**	**$2,228**	**$1,064**	**$1,181**	**$935**	**$930**	**$1,315**
Ratio of Labor to Total	77%	71%	75%	97%	96%	96%	96%	97%

4. Historical Variance Analysis

(1) Labor

As seen in Figure II-6,[7] labor costs for Planning, Continuity and Governance activities remained relatively stable from 2014 to 2016. In 2017 labor costs decreased by $0.6 million as employees within the Business Resiliency Department were re-assigned to Emergency Management (see SCE-04, Vol. 2) activities to supplement SCE's response and recovery team addressing emergencies, including wildfires. The decrease was also attributable to certain staff vacancies in Planning positions that were filled in 2018.

(a) Non-Labor

As seen in Figure II-6, non-labor costs from 2016 to 2017 showed a significant decrease as compared to previous years (2014-2016). Like labor costs, this decrease was attributable to an increased focus on Emergency Management activities. The shift in focus resulted in

[7] Refer to WP SCE-04, Vol. 01, WP, pp. 1-7– O&M Detail for Planning, Continuity & Governance.

the reassignment of employees and associated non-labor costs moved to Emergency Management activities during 2017 and 2018.

5. Scope and Forecast Analysis

For Test Year 2021, SCE forecasts $1.3 million in O&M costs supporting the Business Continuation BPE covering Planning, Continuity and Governance work activities. As described above, costs declined as a result of staff being moved to other departments in 2017. Our costs stabilized in 2018 as we filled vacancies in our staff, so we have used 2018 recorded costs as a base estimate. During 2019 and 2020 labor costs are projected to decrease by approximately $0.2 million each year due to further reassignment of employees from this work activity to support activities under the Emergency Management BPE. The Test Year 2021 forecast uses projected 2020 costs as a baseline which is then adjusted to account for an increase of $0.4 million for additional staff necessary to support the IT DR Program. The staffing increase is based on the level of projects supporting recovery planning for technology infrastructure and essential and critical enterprise applications during 2021.

We expect non-labor costs to be slightly lower than the low level of expenses incurred in 2018 through the GRC cycle.

As described in greater detail above, these activities support overall planning for response and recovery operations to emergencies such as severe weather events, wildfires and other catastrophic emergencies that impact safe and reliable service.

C. All Hazards Assessment, Mitigation, and Analytics

1. Work Description

The objectives of SCE's All Hazards Assessment, Mitigation and Analytics activities are to (1) identify and analyze SCE's exposure to natural and man-made hazards and their potential impact, (2) develop and coordinate efforts to mitigate the impacts using industry standards or best practices, and (3) improve analytics and technology to support business resiliency functions. The All Hazards Assessment, Mitigation and Analytics activities are broken up into four programs: (1) Seismic Assessment & Mitigation Program, (2) Climate Adaptation & Severe Weather Program, (3) Targeted Hazard Analysis, and (4) Analytics & Technology Integration.

Seismic Assessment and Mitigation Program

The Seismic Assessment and Mitigation Program was formed in 2015. The program centralizes all seismic related work company-wide to provide consistency in approach, prioritization of work, and reporting.

SCE's Business Resiliency Department manages the program and works with multiple business lines across the company in executing seismic assessment and mitigation projects for (1) Electric Infrastructure, (2) Non-Electric Facilities, (3) Generation and (4) Information Technology (IT)/Telecommunications Infrastructure.

Table II-6
Facilities Covered by the Seismic Assessment and Mitigation Program

Electric Infrastructure	Non-Electric Facilities	Generation Infrastructure	Telecommunication & Information Technology Infrastructure
• Transmission lines/ towers • Transmission substations • Distribution substations • Distribution system	• Populated facilities (Employee/Public) • Data centers • Administrative buildings • Operation/service centers	• High-hazard dams • Powerhouses • Peakers • Generating stations	• Antenna towers • Telecommunications sites • Server racks and equipment

Electric Infrastructure covers electrical assets and equipment needed to support the transmission and distribution of power and includes transmission towers, substations and the distribution system. Non-Electric Facilities include populated buildings, data centers, administrative buildings, operational centers and service centers. Generation Infrastructure covers assets and equipment needed to support the generation of electricity and includes high-hazard dams, powerhouses, peakers and generating stations. IT/Telecommunications infrastructure includes SCE's computing, networking, and telecommunications systems supporting power delivery and operating functions. The projects are designed to better protect the safety of our workers, first responders and the public and enhance our ability to sustain critical operations and business functions during and following a major earthquake.

Climate Adaptation and Severe Weather Program

The Climate Adaptation and Severe Weather Program was formed in 2018. Even prior to its formation and starting in 2015, SCE has worked to better understand climate change impacts on the

electric utility industry through partnerships with the Department of Energy (DOE) and other utilities to develop adaptive measures and practices to potentially reduce climate and weather-related vulnerabilities. Like the Seismic Assessment and Mitigation Program, SCE's Climate Adaptation and Severe Weather Program involves a cross functional team coordinated by the Business Resiliency department to facilitate and develop a consistent approach across the company to analyze climate hazards, identify and implement adaptive measures. Program activities also include analyzing and assessing climate change impacts and related climate science and data to develop a foundational understanding of those impacts and how to address those impacts

Targeted Hazard Analysis

Targeted Hazard Analysis was initiated in 2019. It focuses on mitigating emerging hazards that arise from year to year, such as extreme rain that can lead to flooding of our assets, or mudslides. To mitigate this, SCE performs an annual targeted hazard analysis, using seasonal weather and climate outlooks that may forecast unusual weather patterns and determines if there are any assets that may be impacted by the unusual patterns. This analysis helps plan for immediate mitigation actions that can be implemented in weeks or months, such as temporary retaining walls, to reduce impacts.

Analytics and Technology Integration

Analytics and Technology Integration implements technological solutions to support SCE's business continuation and emergency management efforts. Improved data analytics and technology solutions are vital to providing SCE insight to hazardous weather conditions hours, days and even years in advance. These solutions currently include a storm damage prediction model and tool, business continuity planning, emergency management tools, and Geographical Information Systems (GIS) for mapping and analysis. Activities also include analyzing weather patterns for problematic conditions, installing weather stations and remote sensing tools, and implementing systems for information exchange with public agencies in the event of an emergency. Many of the technology solutions discussed above also support wildfire activities and are captured in SCE-04, Vol. 5, Wildfire Mitigation (under Enhanced Situational Awareness and Fire Science & Advanced Modeling work activities).

The majority of work activities require capital expenditures and are covered in Section D of this volume. Labor O&M costs cover program management and execution for the four programs.

Non-labor O&M costs are incurred in connection with capital projects under the Seismic Assessment and Mitigation, the Climate Adaptation and Severe Weather, and Targeted Hazard Analysis. Those non-labor costs include the removal of equipment from substations and transmission towers

undergoing mitigation project and the temporary relocation of staff during building retrofits. They also include the consultants and professional services from third party vendors assessing, conducting hazard analysis or improving the functionality of software tools used for analysis or information management.

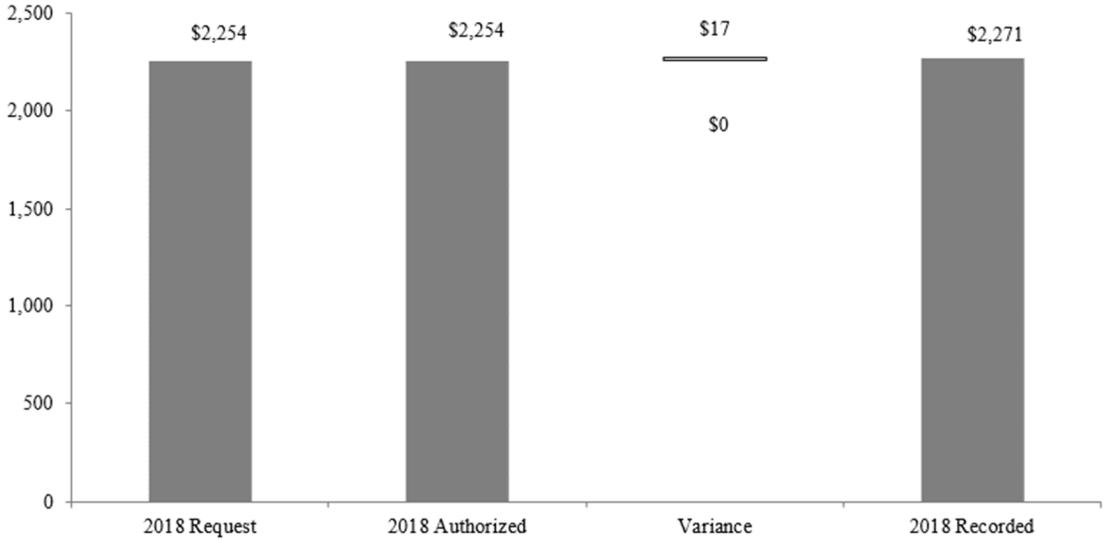
2. Need for Activity

The Seismic Assessment and Mitigation Program supports SCE's efforts to identify and develop reasonable options to mitigate the risk of outages or business disruptions due to seismic events. The forecast covers work activities supporting our continuing capital projects (focusing on retrofits at substations and towers) that started in 2015. These retrofit activities help mitigate the risk of significant damage to SCE substations components during moderate or large earthquakes. Heavy shaking can damage fragile equipment leading to extended outages and considerable repair expense. The forecast also covers temporary staff relocation costs associated with building retrofits planned in 2021-23 to mitigate safety risks while construction activities are in progress.

The Climate Adaptation and Severe Weather Program was initiated by SCE to properly identify and address the hazards and risks for the utility and its customers and workforce arising from climate change. The risks presented to utilities from climate change, including severe weather events and the unpredictable conditions (e.g. significant temperature increases, drought, precipitation pattern changes), must be identified and addressed. This process is the subject of Commission Rulemaking proceeding (R.18-04-019). In line with SED's recommendations, SCE continues to analyze the issues and plan prudent investments.

Finally, analytics and technology play a critical role in preparing for and responding to emergencies within the SCE territory. It provides the ability to detect possible threats potentially years before an event to help inform hardening or preparation efforts and advance planning for an emergency to guide response and recovery operations. SCE retains professional service providers to continually enhance situational awareness tools, like GIS applications and business continuity tools with automated features focusing on greater efficiency and improved data communication to key stakeholders.

Figure II-7[8]
All Hazards Assessment, Mitigation & Analytics
O&M Expenses for 2018 - Authorized versus Recorded
(Total Company Constant 2018 $000)



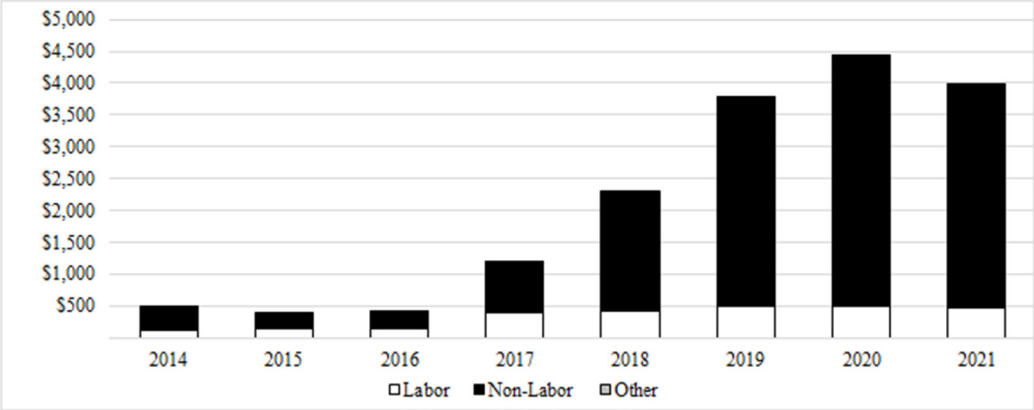
All Hazards Assessment, Mitigation & Analytics	2018 Authorized	2018 Recorded
Labor	$176	$425
Non-labor	$2,078	$1,846
Total	$2,254	$2,271

3. Comparison of Authorized 2018 to Recorded

There was a variance of $17,000 between the total authorized amount versus the recorded amount for this work activity. SCE recorded $0.2 million more than authorized in labor expenses due to the commencement of programs for Seismic Assessment & Mitigation Program and the Climate Adaptation & Severe Weather Program. For non-labor expenses, SCE recorded $0.2 million less than authorized due to schedule changes for seismic projects to address transmission substation outage coordination. These projects are slated for completion in 2019 rather than 2018.

[8] Refer to WP SCE-07, Vol.1 Authorized vs Recorded.

Figure II-8
All Hazards Assessment, Mitigation and Analytics
Recorded 2014-2018/Forecast 2019-2021
(Total Company Constant 2018 $000)



	Recorded					Forecast		
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Labor	$127	$131	$144	$404	$425	$492	$492	$479
Non-Labor	$363	$275	$277	$798	$1,846	$3,300	$3,953	$3,504
Other					$0			
Total Expenses	**$490**	**$406**	**$421**	**$1,202**	**$2,271**	**$3,792**	**$4,446**	**$3,983**
Ratio of Labor to Total	26%	32%	34%	34%	19%	13%	11%	12%

a) Historical Variance Analysis[9]

(1) Labor

From 2014 to 2015, labor costs remained relatively flat at $.1 million and in 2016 increased to $.15 million when the Seismic Assessment and Mitigation Program was launched. Labor increases in 2017 and 2018 were associated with the formation of the Climate Adaptation and Severe Weather Programs and Analytics and Technology Integration activities. The majority of labor costs associated with SCE site-specific seismic assessment and mitigation projects are captured in capital project expenditures.

(2) Non-Labor

From 2014 to 2016, non-labor costs included software technology licenses for SCE Emergency Notification System (ENS), Business Resiliency Information Management System (BRIMS), and Emergency Operation Center software. Between 2017 – 2018, non-labor costs included

[9] Refer to WP SCE-04, Vol. 01, WP, pp. 8-14– O&M Detail for All Hazards Assessment, Mitigation & Analytics (O&M).

employee relocation costs associated with thirteen seismic building retrofit projects and outside consultant costs in 2018 supporting the Climate Adaptation and Severe Weather Program.

b) Forecast

SCE utilized an itemized method to develop the forecast for this work activity by taking 2018 recorded and adjusting for increased activity levels planned for 2021. For Test Year 2021, SCE forecasts $4.0 million for All Hazards Assessment, Mitigation and Analytics work activities. This includes labor and non-labor costs to execute assessment, mitigation and analytics projects and represents an increase of $1.7 million from 2018 recorded costs. This includes non-labor costs to complete the seismic portion of capital expenditure retrofits on SCE electric assets, namely, employee relocation costs during retrofits of non-electric facilities and outside consultants to support Climate Adaptation and Severe Weather Program activities.[10]

4. Basis for O&M Cost Forecast

a) Seismic Assessment and Mitigation Program

SCE's Test Year 2021 forecast of $2.5 million (2018 constant dollars) include administrative and project management support and employee relocation costs associated with electric infrastructure and non-electric facilities mitigation projects. The forecast for electric infrastructure mitigation is $1.7 million, it is based on a percentage (7%) of the forecast for substation retrofit projects. The forecast for non-electric facilities mitigation is $0.8 million and includes costs associated with temporary employee relocations associated with non-electric facility retrofits, This forecast is based on an average relocation cost of $2,000 per employee (including moving essential work equipment such as desks, chairs, computers, files) between the original site and the temporary site then back to the original site once retrofits are completed. We estimate this will average to about 400 employees per year.

b) Climate Adaptation & Severe Weather Program

The 2021 Test Year forecast for the Climate Adaptation and Severe Weather Program is $0.8 million. These non-labor costs are primarily for third party studies and outside consultants needed to conduct detailed assessments utilizing climate change projection models and developing adaptation plans. These assessments are intended to identify vulnerabilities of our assets arising from climate change by evaluating the short-term and long-term impacts climate change may

[10] Refer to WP SCE-04, Vol. 01, WP, pp. 15-20 – All Hazards Assessment, Mitigation & Analytics (O&M).

have on SCEs assets and operations. Assessments involve site visits or location specific analysis of assets and analysis of fluctuating weather patterns such as high temperature and precipitation variations.

This forecast represents $0.3 million for a multi-year assessment on renewables and the impact of climate change to energy resources to address energy availability at the Western Electricity Coordinating Council (WECC) system level. The assessment shall gauge the impacts of climate change on the western supply of energy and support development of a long-range plan to address climate changes and extreme weather events on renewable energy resources.

The forecast also includes $0.4 million for climate adaptation consultants to develop plans for SCE who have previously developed similar plans for government agencies (including the Department of Energy) and other utilities.

The remaining costs cover expenses included in the forecast for non-capitalized costs associated with projects at 48 substations to mitigate potential damage from high precipitation levels and flooding.

c) Targeted Hazard Analysis

SCE's 2021 Test Year forecast for Targeted Hazard Analysis is $0.2 million. These costs cover detailed emergent hazard assessments of transmission sites, engineering plans, engineering studies and inspections, and mitigation work for the sites projected to be impacted by severe weather events. The forecast is based on historic costs of similar activities associated with pre-emptive analysis and mitigation. Examples of the mitigation work include; k-rail barriers along certain sides of poles and tower footings, installing visqueen (vapor barrier/plastic sheeting), sand bags, native soil berms, and gabion baskets for slope stabilization or retaining walls as necessary.

d) Analytics and Technology Integration

Only labor related costs are associated with the Analytics and Technology Integration program. License and purchasing costs associated with information management software used for business continuity planning, and situational awareness tools used in the EOC prior to and during the activation of an IMT to support recovery activities area are not captured in this testimony. Costs are embedded in SCE-04, Vol. 3, Cybersecurity and in SCE-04, Vol. 5, Wildfire Mitigation.

e) RAMP Integration

The All Hazards, Assessment, Mitigation & Analytics work activity is responsible for two of the controls identified in SCE's RAMP report and listed in the table below. SCE's Seismic Building Safety Program represents the non-electric facility portion of work conducted under the

Seismic Assessment and Mitigation Program by assessing seismic hazards and executing mitigation projects to address offices and other operational facilities.

The Climate Adaptation & Severe Weather Program works with internal/external subject matter experts to better understand climate change impacts on the electric grid and business operations. These efforts are also geared towards mitigation of safety, reliability and financial consequences to SCE.

Table II-7
All Hazards, Assessment, Mitigation & Analytics (O&M)
RAMP vs. GRC O&M Forecast Comparison
Nominal 2018 $000

RAMP Risk	RAMP ID	RAMP Control / Mitigation Name	Filing Name	2019	2020	2021
Building Safety	C1	Seismic Building Safety Program	RAMP	$ 1,031	$ 1,031	$ 1,031
Climate Change	M1	Climate Adpt & Svr Wthr		$ 527	$ 383	$ 389
Total				**$ 1,558**	**$ 1,414**	**$ 1,420**
Building Safety	C1	Seismic Building Safety Program	GRC	$ 831	$ 1,032	$ 833
Climate Change	M1	Climate Adpt & Svr Wthr		$ 646	$ 703	$ 854
Total				**$ 1,477**	**$ 1,735**	**$ 1,687**
Building Safety	C1	Seismic Building Safety Program	Variance	$ (200)	$ 1	$ (198)
Climate Change	M1	Climate Adpt & Svr Wthr		$ 119	$ 320	$ 465
Total				**$ (81)**	**$ 321**	**$ 267**

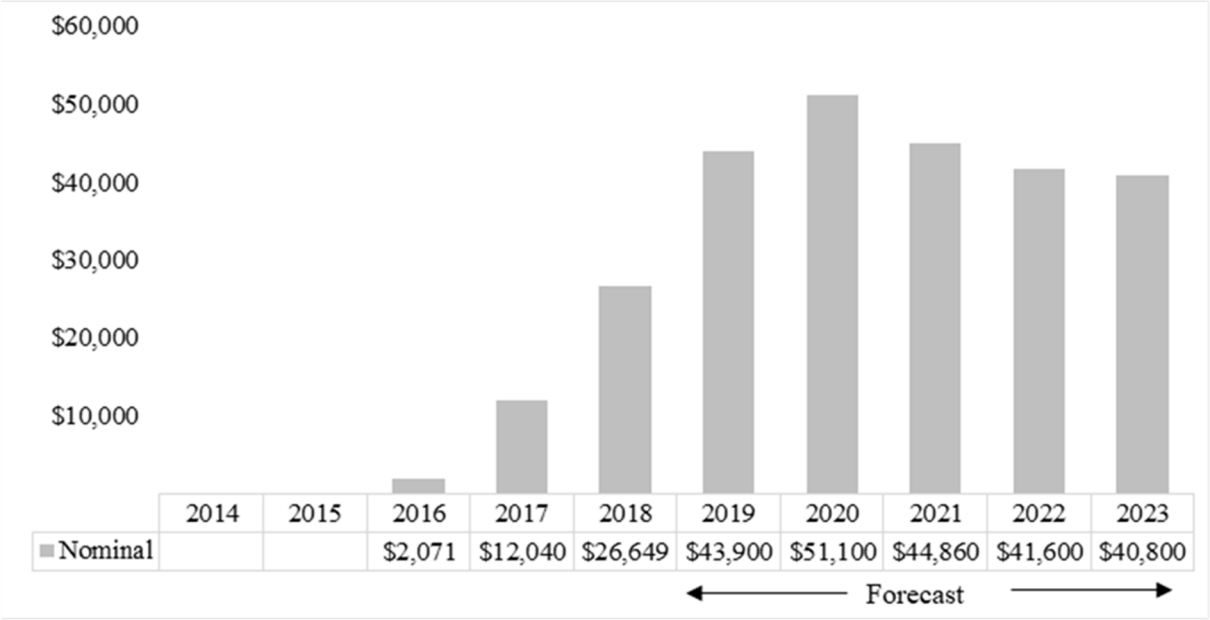
f) Reconciliation Between RAMP and GRC

The variance for Seismic Building Safety Program is due to updated forecasts of non-labor expenses related to employee relocations during seismic retrofits. For Climate Adaptation and Severe Weather, the increase from 2019 – 2021 is based on higher level of work (and associated costs) for climate vulnerability assessments and evaluation of near- and long-term mitigations of climate impacts.

D. Capital Expenditures

1. All Hazard Assessment, Mitigation, and Analytics

Figure II-9
All Hazards Assessment, Mitigation, and Analytics
Capital Expenditure
(Recorded 2014-2018/Forecast 2019-2023 Forecast)



	Recorded							Forecast
	2016	2017	2018	2019	2020	2021	2022	2023
Climate Adaptation & Severe Weather					$200	$1,360	$2,600	$2,600
Seismic Assessment & Mitigation	$2,071	$12,040	$26,649	$43,900	$50,900	$43,500	$39,000	$38,200
Totals	**$2,071**	**$12,040**	**$26,649**	**$43,900**	**$51,100**	**$44,860**	**$41,600**	**$40,800**

a) Seismic Assessment and Mitigation Program

The capital forecast for the Seismic Assessment and Mitigation Program includes: (1) assessment of SCE's electric infrastructure, non-electric facilities, generation infrastructure and telecommunications/IT infrastructure to identify what seismic mitigations are needed, and (2) implementation of the necessary retrofits and improvements.

SCE's Business Resiliency department oversees the Seismic Assessment and Mitigation Program and implements consistent standards and processes across the company. Team members coordinate seismic assessments and mitigation work with the OU bearing primary responsibility for the assessed sites (e.g. Transmission and Distribution OU for Electric Infrastructure, Corporate Real Estate OU for Non-Electric Facilities, Power Production OU for Generation Infrastructure and IT OU for Telecommunication/IT Infrastructure). Experienced contractors are

retained to perform assessments and monitor expenditures. Once assessments are completed, projects are prioritized based on criticality.

Assessments include gathering hazard data, running analysis of the hazards against our infrastructure to evaluate damage to assets if such hazards occur, and determining engineering improvements to mitigate the possible damage. These assessments on our infrastructure and facilities help inform (1) the seismic exposure and impacts of seismic events, (2) the functionality and stability of the infrastructure in the event of a seismic event[11], and (3) the regulatory (e.g. FERC compliance for High Hazard Dams) and internal standard compliance (e.g., Internal design standards for substations) requirements.

Mitigation work varies based upon the type and condition of the infrastructure. Examples of mitigations include bracing and anchoring electrical equipment in substations, reinforcing building walls to roofs, and replacing older equipment with equipment better able to withstand seismic impacts. Seismic mitigations are prioritized with a primary focus on safety and planned and executed to minimize service interruptions. Projects with the most significant safety, reliability, and compliance impact are given the highest priority.

To date, the highest priority projects have involved densely populated and/or highly trafficked facilities. Other high priority projects include various transmission, distribution, generation and IT/Telecommunications infrastructure critical to maintaining system stability and operational reliability. Mitigation efforts for the highest priority projects are forecast to be completed by the end of 2020. This work was the subject of SCE's 2018 GRC and continues in this GRC. Further seismic work is also expected to be the subject of future rate cases.

(1) A Phased Approach

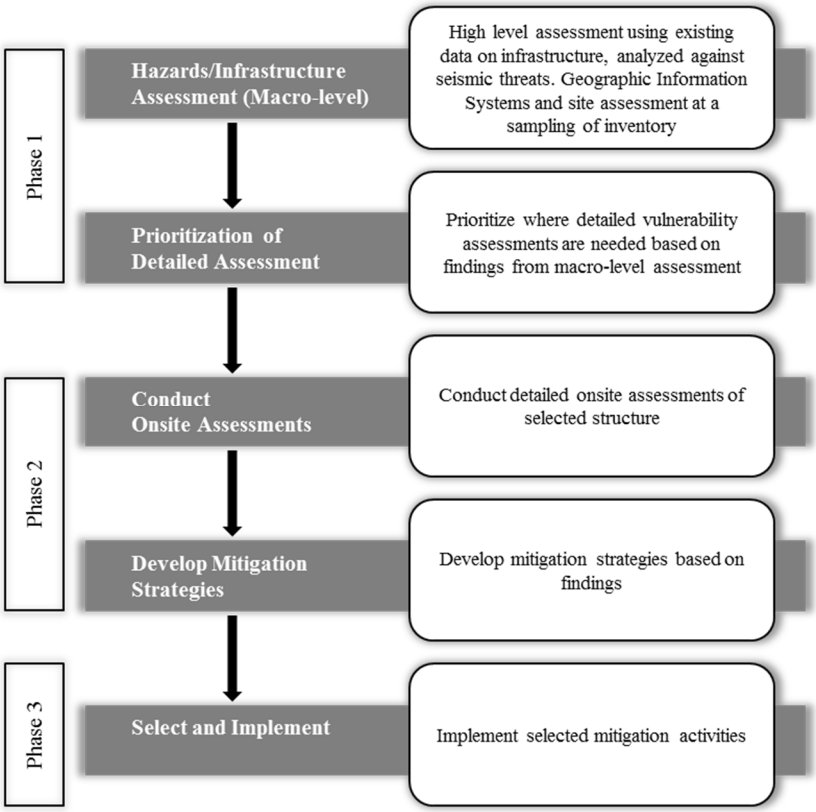
SCE's Seismic Assessment and Mitigation Program involves the three-phased approach outlined in Figure II-10 below. This phased approach provides a cost efficient method to identify where mitigation investments need to be made to SCE large inventory of buildings, electrical infrastructure, generation and IT infrastructure. SCE started this process in 2016. Phase I commenced with a broad assessment of electric and non-electric infrastructure using readily available data against

[11] SCE collaborates with members of the scientific and academic communities to validate methodologies and retains vendors who specialize in assessing the seismic vulnerability of infrastructure.

(*Continued*)

two probabilistic scenarios provided by the U.S. Geological Survey.[12] This screening process identified structures requiring more detailed site assessments. Phase II involves completing the detailed assessments and identifying the mitigations required. Phase III involves implementation of the mitigations. Given the volume and variety of infrastructure, assets will be at varying stages in the process at a given time. SCE has completed most of Phase I and, between 2019-2023, most sites/structures will be in Phases II and III. In addition, this process will continue to be informed by updates to science and engineering technology.

Figure II-10
Seismic Assessment and Mitigation Program:
Three-Phased Approach



b) Climate Adaptation and Severe Weather Program

Following the State's guidance, SCE formalized a cross-functional program management office in 2018 and retained experts to conduct climate change vulnerability and impact

[12] Refer to https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga2pct.pdf and https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga10pct.pdf.

assessments. Certain foundational work was identified in SCE's RAMP report for the 2021 GRC. The program is also informed by the Commission's Climate Change Adaptation Order Instituting Rulemaking (R.18-04-019).

SCE has initiated a regional macro-level assessment of our infrastructure, like that performed in relation to seismic risk under the Seismic Assessment and Mitigation Program. Like government agencies at all levels, SCE is using publicly available climate change model data to conduct this initial assessment. To date, this assessment has indicated that near term impacts of climate change will likely result in severe weather events impacting our service territory. Therefore, SCE plans certain near-term action, including efforts to mitigate the impact of flooding at our substations based on projects of intense rainfall during shorter rain seasons. Given the inherent limitations of using weather and climate data from publicly available sources which is not tailored for electrical utilities and related infrastructure, SCE is working with members of the scientific community to improve available models for utility purposes. SCE will also be conducting detailed assessments on the actual conditions that are occurring at a specific site or asset and its likelihood of occurrence resulting from changes to the climate. This includes installation of ocean monitors to measure the change of storm surge because of sea level rise, ground monitors to measure changing landslide potential due to changes in precipitation, and weather stations to better understand how urban heat areas impact our territory.

2. <u>Basis for Capital Expenditure Forecast</u>

a) <u>Seismic Assessment and Mitigation Program</u>

The capital forecasts are derived from several sources. Forecasts for assessments are based on historic costs from similar work and estimates from third-party engineering firms performing seismic assessments for the four types of infrastructure (i.e., Electric, Non-electric, Generation, IT/Telecomm) between 2019-2023. The forecasts are derived by itemizing costs based on the type of assessment, the number of assets or sites to be assessed, and the final reporting requirements of the assessment.

Mitigation activities are forecast using a similar itemized approach. For electric infrastructure projects, estimates are based on the recommended work scope and schedule, historic costs of projects with similar scope, and certain itemized construction costs. For non-electric facilities, project costs are based on a per square foot unit estimate provided by a third-party engineering firm considering the requisite materials, construction, and supporting activities by building type. The forecast was then derived by applying that estimate to the planned mitigation projects at non-electric facilities from 2019-

2023. For generation mitigation projects, the forecast was derived by taking the engineering assessment recommendations, itemizing the scope, and applying per unit cost estimates from SCE Generation engineering and asset management groups. Finally, for IT/Telecomm mitigation projects at data centers, the cost is based on estimates from a third-party engineering firm based on identified scope to complete non-structural retrofits. For IT/Telecomm work related specifically to mitigation for computer/server racks, internal per unit cost estimates were generated based on historic costs for the same type of work and applies to forecast those costs.

(1) Electric Infrastructure[13]

Table II-8
Seismic Assessment & Mitigation Program
Electric Infrastructure Forecast
(Nominal $000)

CWBS	Sub-work Activity	2019	2020	2021	2022	Forecast 2023
COS00SPBR000000	Transmission Substation/Line/Tower Assessment	$ 2,100	$ 2,100	$ 300	$ 300	$ -
COS00SPBR000001	Distribution Substation Assessment	$ -	$ -	$ 2,000	$ 4,500	$ 4,000
COS00SPTD000000	Transmission Substation Mitigation	$ 24,000	$ 24,000	$ 21,000	$ 8,000	$ 8,000
COS00SPTD000002	Transmission Lines / Tower Mitigation	$ 4,000	$ 4,000	$ 3,300	$ 3,300	$ 3,300
COS00SPTD000003	Distribution Substation Mitigation	$ 4,000	$ 7,000	$ 4,100	$ 4,100	$ 4,100
Electric Infrastructure Total		**$34,100**	**$37,100**	**$30,700**	**$20,200**	**$19,400**

Between 2019-2023, SCE forecasts expenditures of $85 million to complete 58 transmission substation assessment and mitigation projects. Transmission substations support hundreds of thousands of customers by moving power from high voltage transmission lines to lower voltage distribution systems. Given their size, assessments included site visits to inventory the different types of equipment and to address their unique configurations. The assessment also includes software assisted analysis to identify where earthquakes may have the most impact on transmission substation equipment.

[13] Refer to WP SCE-04, Vol. 01, WP, pp. 29 -37 – All Hazards Assessment, Mitigation & Analytics (Capital).

Engineers then work to identify improvements that could be made to mitigate damage and inoperability due to a major earthquake.

Mitigation projects include replacing older fragile transformer bushings, securing hanging and suspending equipment at the end of transmission lines, and taking step to place enough conductor slack and avoid conductor snaps during an earthquake. Project work is based the recommendations of a third-party earthquake engineering consultant and focused on improving lower-cost components that reduce the likelihood of an outage. The mitigation design is based on the Institute of Electrical and Electronics Engineers Standard 693, Recommended Practice for Seismic Design of Substations.

From 2021 to 2023, SCE forecasts $44 million for detailed engineering assessments of transmission buildings and retrofits of sixteen buildings known as Mechanical Electrical Equipment Rooms (MEER). A portion of this forecast, $15 million, is shown in Table II-8 and the remaining $29 million is shown in Table II-9.[14] MEERs house critical IT and electrical control infrastructure to operate a substation. MEERs support critical power delivery functionality to distribution substations after an earthquake. Assessments involve engineering site visits, examination of engineering drawings, and evaluation of whether the building can withstand shaking.

When mitigation is required, the project includes the development of engineering designs based on ASCE 41 guidelines, California Building Code requirements and internal design criteria specific to substations. Mitigation will also include construction activities to strengthen the walls of a building or adding more roof to wall connections so that the building is safe to exist after an earthquake and can continue to operate quickly after an earthquake.

Between 2019-2023, SCE forecasts $18 million to assess approximately 9000 transmission towers in earthquake and landslide prone areas and to mitigate approximately 18 towers. Transmission towers are susceptible to damage from an earthquake when the ground shifts after an earthquake, causing the tower to move or fall. Since transmission towers are often situated in areas of high elevation and at risk of landslides following an earthquake, the initial assessment involves cross-referencing GIS data with landslide maps from the California Geological Survey near the location of towers to gauge risks presented by landslides to the transmission towers. Thereafter, a site-specific engineering and geotechnical soil sampling is conducted to determine what can be done to the area

[14] Refer to WP SCE-04, Vol. 01, WP, pp. 31-35 – Forecast - Seismic Assessment & Mitigation: Electric Infrastructure – Transmission Substation Mitigation (Capital).

below and around the tower to mitigate harm. SCE has performed site assessments along the Cajon Pass and Tejon Pass to assess the geology of the area around the towers. Based thereupon, eight towers have been prioritized for mitigation between 2019-2020. Ten more sites are currently being prioritized for construction and completion between 2021-2023. Examples of mitigation activities include constructing retaining walls and stabilizing the ground using soil nails to prevent landslides.

Between 2019-2023, SCE forecasts $32.5 million for the assessment of up to 200 distribution substations and mitigation of ten distribution substations. SCE has over 730 distribution substations in its inventory which supply power directly to customers, businesses, police/fire stations, hospitals, water treatment plants and pumping stations. The distribution substations are smaller in scale and deliver less power per unit than transmission substations but share similar vulnerabilities. Assessments totaling $10.5 million include desktop analysis, software-assisted component analysis, and on-site inspections of up to 200 distribution substations to evaluate electrical equipment (e.g. transformers) and structural elements. Based upon these assessments, mitigation projects are prioritized based on the assets most likely to fail and cause service disruption. Mitigation projects comprise $22 million of the forecast and includes final design and construction activities to properly anchor components, strengthen switchracks, provide adequate conductor slack, and replace older transformer bushings with newer material to avoid damage.

(2) Non-Electric Facilities[15]

Table II-9
Seismic Assessment & Mitigation Program
Non-Electric Facilities Forecast
(Nominal $000)

CWBS	Sub-work Activity	2019	2020	2021	2022	Forecast 2023
COS00SPRE000000	Non-Electric Facilities	9,000	13,000	12,000	18,000	18,000

Between 2019-2023, SCE forecasts $41 million to assess and retrofit 27 non-electric facilities (primarily offices and operational buildings supporting power delivery.) These assessments evaluate the safety of SCE non-electric facilities for the workers and visitor who occupy

[15] Refer to WP SCE-04, Vol. 01, WP, pp. 38 – Forecast - Seismic Assessment & Mitigation: Non-Electric Infrastructure (Capital).

and use those facilities. SCE uses assessment guidelines from the Federal Emergency Management Agency P-154 Rapid Visual Screening of buildings for Potential Seismic Hazards (FEMA P-154) for initial assessment and the American Society of Civil Engineers Standards for Seismic Evaluation and Retrofit of Existing Buildings (ASCE 41) for detailed engineering assessment. To date, FEMA P-154 screening has been completed 319 facilities and ASCE 41 evaluation has been performed at 70 buildings.

Mitigation projects include structural retrofits where connections are added from the wall to the roof and walls are strengthened to mitigate risk of collapse during a seismic event. Based upon historic costs, these retrofits incur an average cost of $45 per square foot and take approximately 18 months. The completion dates can vary based upon the type of the building.

(3) IT/Telecommunications Assets

SCE has in its inventory of over 890 sites with computing, network, or communications infrastructure to support the wide mobile radio network in our service territory, including telemetry for power delivery assets. Since the last GRC, telecommunications and information technology assets have been added as an area of focus for the Seismic Assessment and Mitigation Program. In 2017, SCE began developing specific assessment procedures for this asset class and assessing telecommunications towers, computer hardware and systems on computer racks, and the overall integrity of data centers. Assessments entail engineering evaluations of the strength of racks and telecommunications equipment and potential damage and telecommunications failure due to seismic events. Such damage and failure would leave transmission substations unable to communicate with a centralized control center and lead to a widespread service disruption, longer restoration time and additional recovery procedures that could cause further disruptions across our service territory.

At present, fifteen sites have been assessed and prioritized based on importance to networking and communications support for transmission systems. Mitigation projects for these fifteen sites are planned from 2019-23. The projects include non-structural retrofitting and strengthening computer and server rack equipment. These expenditures totaling $1.25 million are included in the forecast for Non-Electric Facilities referenced in the section above.

(4) Generation Infrastructure[16]

Table II-10
Seismic Assessment & Mitigation Program
Generation Infrastructure Forecast
(Nominal $000)

CWBS	Sub-work Activity	2019	2020	2021	2022	Forecast 2023
COS00SPPP000000	Generation Infrastructure	800	800	800	800	800

Between 2019-2023, SCE forecasts $4 million for continuing assessment and mitigation work at generation facilities. This includes assessments of our high hazard dams requested by FERC and the California Department of Water Resources, Division of Safety of Dams (DSOD).

SCE forecasts approximately $1.8 million for ongoing assessments of high hazard dams to meet FERC compliance requirements. Assessments include site investigation, soil and material sampling, detailed computer modeling, and engineering analysis.

SCE will also complete assessment of fifteen powerhouses and four gas-fired peakers. Assessments of five powerhouses will be completed by 2018 and ten powerhouses will be assessed from 2019-2023. Each assessment is estimated to cost $1 million and involves on-site engineering inspections reviewing structural and non-structural (e.g. heavy equipment) parts of the site and identification of seismic vulnerabilities and mitigations (including design improvements or retrofits.) These assessments support emergency response and restoration of service to impacted parts of the territory.

Non-structural retrofits planned in response to assessment are intended to prevent heavy equipment from moving and becoming damaged and reinforce areas where rock falls may occur. From 2019-2023, SCE forecasts $1.2 million for retrofits, including bracing and tying down heavy equipment. These cost-effective retrofits mitigate the potential for heavy equipment movement that could cause injuries and equipment damage. Such heavy equipment includes computing, plumbing,

[16] Refer to WP SCE-04, Vol. 01, WP, pp. 39-40 – Forecast - Seismic Assessment & Mitigation: Generation Infrastructure (Capital).

or air conditioning systems that support the rest of the facility and are necessary for the plant or facility to operate effectively.

b) Climate Adaptation and Severe Weather Program

From 2020-2023, SCE forecasts $6.76 million of capital expenditures supporting the Climate Adaptation and Severance Weather Program. The forecasts for analysis, assessments and installation and maintenance of monitoring equipment are based on historic costs where past work has been completed and estimates from third party consultants and vendors estimates absent such historic costs. The forecast for substation mitigation work is based on engineering and project management estimates based on itemized material, construction and project management costs.[17]

Table II-11
Climate Adaptation and Severe Weather Program Forecast
(Nominal $000)

	2020	2021	2022	Forecast 2023
Climate Adaptation & Severe Weather	$200	$1,360	$2,600	$2,600
Totals	**$200**	**$1,360**	**$2,600**	**$2,600**

Using publicly available data and analysis of past events, SCE has identified certain substations that are subject to weather hazards driven by climate change. We have identified up to 300 sites that may have precipitation induced landslide risk or wind risk and requires further assessment. Since 2000, ten transmission towers have failed due to extreme high winds and microburst activity. The program identified 44 substations in a 100-year flood plain, meaning that any of these substations in any one year will have a one percent chance of flooding. Over the course of a 30-year asset life, this results in a 26 percent chance of flooding. The program has also identified 48 substations are currently experiencing flooding impacts when heavy rains or high tides occur. SCE will conduct detailed site visits of these locations to determine the specific risk of failure and the cost-effectiveness of measures to prevent weather related damage. These assessments will consider climate change projections to determine if an increased risk exists based on anticipated shifts in weather and environmental conditions. SCE forecasts $5 million dollars to manage flooding issues currently occurring at 48 substations. Work will include addressing erosion issues, adding flood pumps, and re-

[17] Refer to WP SCE-04, Vol. 01, WP, pp. 41-42 – Forecast - Climate Adaptation & Severe Weather Program (Capital).

engineering parts of substations that currently flood in heavy rains. Cost range from $25,000 to $500,000 per substation.

SCE forecasts $1.8 million between 2020-2023 for environmental monitoring and data collection efforts related to the impacts of sea level rise, landslide potential, and urban heat effect on assets. SCE forecasts $0.5 million to install ten monitors of sea level rise from 2020-2023. These monitors capture sea level rise and coastal flooding data at SCE substations and assets in Long Beach, Orange County, Ventura County, and Catalina. Assets in these locations currently flood during coastal storm surge or high tides. SCE, through a partnership with the Scripps Institute of Oceanography, will install sensors to monitor and model the likelihood of storm surge or high tide damage at the locations above. Advanced notice of storm surge allows SCE to take steps to mitigate the impact on operations hours or days ahead of time. The data and monitors will also help to better understand climate change and inform long term asset site planning and prudent investments.

The forecast also includes $1 million for the installation of ten infiltrometers near SCE assets (e.g., Transmission Towers) at a cost of $100,000 per device. An infiltrometer is a device used to measure the rate of water infiltration into soil or other porous media and to determine when or where landslides may occur. Active monitoring at specific locations enhances publicly available data and provides more site-specific assessment of landslide potential. The data concerning landslide susceptibility coupled with climate projection models will help guide actions by SCE to mitigate increased risk of landslides in designated areas.

SCE also forecasts $0.1 million for the installation of weather monitors in urban areas in our service territory. Unlike those used to monitor weather conditions for wildfire risk, these monitors are intended to assess temperature changes and variation in urban heat areas. The data provided will assist in system planning and provide insight on potential discrepancies of modeled temperatures and observed actual temperatures.

SCE also forecasts $0.2 million between 2021-2023 for the installation of monitoring equipment and the performance of engineering and environmental analysis around generation assets. The data will be coupled with climate models to develop operational models for near term planning (hours to days ahead) and long-term planning (months, seasons, years ahead). The objective is to identify changes in the environment, improve integration of weather data and climate models, and better inform long term investment decisions for generation assets.

3. Need for Capital Project or Program Including Risk Avoided

a) Seismic Assessment and Mitigation Program

SCE's infrastructure system is widely dispersed, complex and interdependent. The impacts of a major earthquake can create physical damage to infrastructure and buildings, but it can also affect the resiliency of the company by affecting our workers and the infrastructure we rely on to deliver electrical service to our customers. SCE has centralized seismic assessments and mitigation planning to better understand these interdependencies and impacts across the entire infrastructure system, everything from electrical to non-electrical, generation and IT/Telecommunications infrastructure.

(1) Impacts to safety

A coordinated and company-wide seismic program is essential to SCE reducing the risk of a moderate or major earthquake causing substantial harm to workers, customers, and communities. Seventy-eight percent of SCE non-electric facilities (such as occupied buildings and warehouses) were built prior the 1994 Northridge earthquake. From SCE's detailed assessments, 18 buildings have been retrofitted, including service centers utilized by SCE employees and members of the public.

The program has also focused on older distribution poles with heavy equipment on overhead platforms. Improvements include replacement or bracing of the older overhead platforms. Several distribution poles with overhead equipment were retrofitted in the Ridgecrest area prior to the earthquakes that occurred in July 2019 measuring 6.4 and 7.1 in magnitude and avoided damage from those events.

SCE owns and operates 22 high hazard dams – some dating back as far as the early 1900's. FERC requires inspections and dam safety reviews by an independent consultant every five years to mitigate public safety risks when subjected to extreme seismic loads. The forecast supports the continuation of those assessments and includes seismic retrofitting of one of SCE's high hazard dams.

(2) Impacts to service reliability

A major seismic event like a large earthquake along the San Andreas fault can severely damage SCE's infrastructure and its ability to provide reliable electric service. SCE's electric infrastructure includes transmission lines, towers and substations to distribution lines, poles and substations. SCE's infrastructure, like many of the critical lifelines in Southern California may be

susceptible to significant damage and loss of service following a major earthquake. For example, transmission lines and towers that move high voltage electricity from long-distances across the SCE service territory are typically built to withstand impacts from high-wind, ice-wind combinations, and unbalanced longitudinal wire loads. These towers may be susceptible due to damage caused by landslides or ground displacement. The inability for these corridors to function after a significant event, such as an earthquake, would significantly delay restoration of power to the area. Findings indicate that twenty percent of SCE equipment was installed pre-2005 and these older components may require retrofitting or replacement to avoid significant damage that could have operational impacts such as maintaining control and safety of the grid and avoiding wide-scale outages. In a significant event that may cause a system-wide black out, SCE generating capability will be needed to restart the grid. Due to the age of its generation infrastructure dating as far back at the early 1900s, SCE completed detailed assessments with the support of the third-party engineering firm, of its gas-fired peakers, powerhouses and has determined where appropriate retrofits or mitigations are recommended. Forecasts in this GRC include mitigation activities recommended as an outcome of those findings.

(3) Impacts to the community

Electricity is critical to earthquake response by those such as law enforcement, first responders, critical care providers, search and rescue teams, and relief organizations to help those in need. SCE's ability to quickly restore power and continue its operations following a major earthquake has a direct impact on how the communities it serves recover. Power restoration following a disaster is a key indicator used by emergency managers to gauge when communities transition from response to recovery efforts.

b) Climate Adaptation and Severe Weather Program

Significant local, state, and national efforts are currently in progress to understand the impacts of climate change. The CPUC's OIR on guidance for climate change adaptation for utilities stresses the need to understand the possible risk of climate change on the utility and its main task to provide safe and reliable services to its customers. Therefore, SCE is taking a proactive approach to learn about climate projections data and science. Climate science and data which are long term projection models of what we can expect in 20 years and beyond is different from the weather data that SCE currently uses, which is historically derived from the past 10 to 30 years. This gives the Company an idea of what we expect to experience in the next few days to months or what the weather might look like in the next few years.

(1) Impacts to Safety

The substation mitigation work addresses flooding impacts, including potential safety hazards to SCE staff working in these substations after heavy rain events.

(2) Impacts to Service Reliability

The substation mitigation work also mitigates the impact of severe precipitation events on substation operations. Monitoring and analysis of changing weather conditions helps avoid negative impacts on our assets and our ability to provide service both in the near term and into the future as conditions change over the next 30 years.

(3) Impacts to Communities

Analysis of climate change impacts will inform our engagement with our customers and communities. By reviewing current processes to determine how climate data can be incorporated into internal planning efforts, SCE can better plan for responding to severe weather issues around electrical assets and utilize site inspections to evaluate the root causes of any issues. By merging climate change data with assessments of the potential impact on assets, this analysis helps identify measures to reduce the risk including operational changes and system hardening efforts.

4. RAMP Integration

As described in the RAMP Integration section above, the All Hazards, Assessment, Mitigation & Analytics work activity is responsible for two of the controls identified in SCE's RAMP report and listed in Table II-12 (see RAMP ID C1).

SCE's Seismic Building Safety Program assesses seismic hazard and executes mitigation projects to reduce potential safety and reliability consequences at office and operational facilities. This is the non-electric facilities portion of the Seismic Assessment and Mitigation Program.

The Climate Adaptation & Severe Weather Program works with internal and external subject matter experts to better understand climate change impacts on the electric grid and business operations over an extended time period. These efforts are also geared towards mitigation of safety, reliability and financial consequences.

Table II-12
All Hazards Assessment, Mitigation & Analytics Controls and Mitigations
RAMP vs GRC Capital Forecast Comparison
Nominal 2018 $000

RAMP Risk	RAMP ID	RAMP Control / Mitigation Name	Filing Name	2019	2020	2021	2022	2023
Building Safety	C1	Seismic Building Safety Program	RAMP	$ 6,608	$ 5,619	$ 6,500	$ 6,500	$ 6,500
Climate Change	M1	Climate Adpt & Svr Wthr		$ -	$ -	$ -	$ -	$ -
Total				**$ 6,608**	**$ 5,619**	**$ 6,500**	**$ 6,500**	**$ 6,500**
Building Safety	C1	Seismic Building Safety Program	GRC	$ 9,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
Climate Change	M1	Climate Adpt & Svr Wthr		$ -	$ 200	$ 1,360	$ 2,600	$ 2,600
Total				**$ 9,000**	**$ 8,200**	**$ 9,360**	**$ 10,600**	**$ 10,600**
Building Safety	C1	Seismic Building Safety Program	Variance	$ 2,392	$ 2,381	$ 1,500	$ 1,500	$ 1,500
Climate Change	M1	Climate Adpt & Svr Wthr		$ -	$ 200	$ 1,360	$ 2,600	$ 2,600
Total				**$ 2,392**	**$ 2,581**	**$ 2,860**	**$ 4,100**	**$ 4,100**

a) Reconciliation Between RAMP and GRC

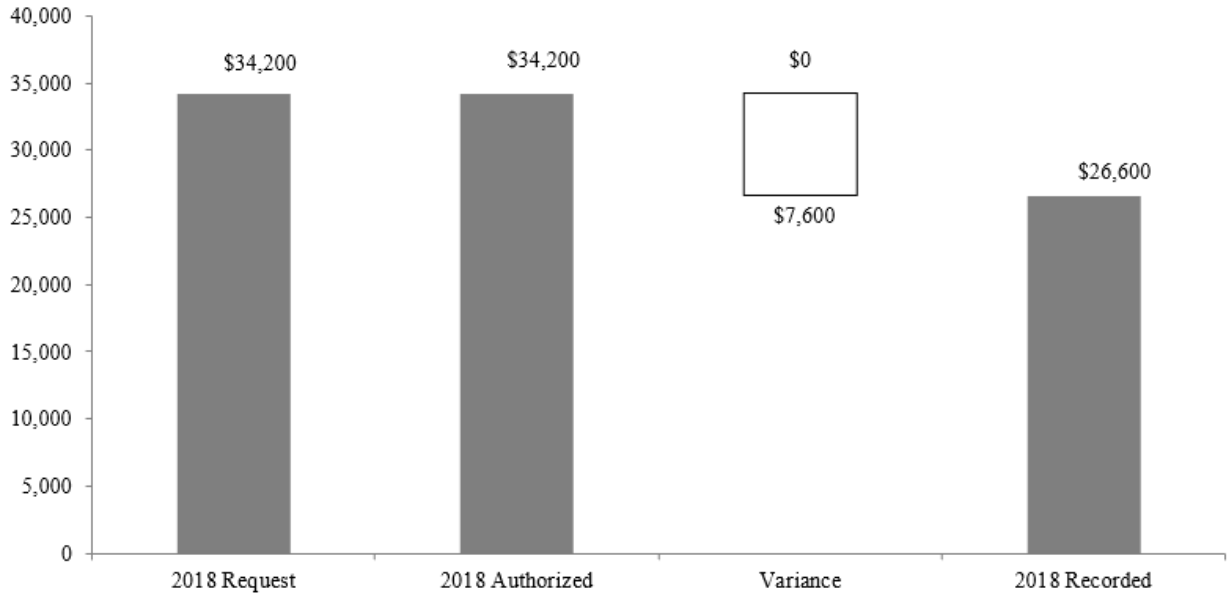
From 2019 – 2023, the variance of $9.23 million for the Seismic Building Safety Program (see RAMP ID C1 in Table II-12) arises from additional scope of work associated with retrofit of one of SCE's larger office buildings and updated cost estimates of work based on historic costs of similar projects that have been completed.

From 2019-2023, the variance of $6.76 million for the Climate Adaptation and Severe Weather Program (see RAMP ID M1 in Table II-12) includes $5 million for substation upgrades to mitigate flooding issues that currently occur during severe rain events and $1.76 million for the installation of monitors to observe and track coastal storm surge and sea level rise, precipitation-induced landslides, and urban heat areas. At the time of the RAMP Report's submission, SCE was in the process of conducting climate change impact assessments.

b) Comparison of Authorized 2018 to Recorded

As shown in Table II-11 below, the recorded spend in 2018 was $26.6 million versus the authorized amount of $34.2 million. The variance of $7.6 million arose from changes to construction schedules moving work originally planned for 2018 into later years. Those schedule changes support more efficient planning and execution of construction work by encompassing both the seismic retrofit and other needed facility maintenance at transmission substations.

Figure II-11[18]
All Hazards Assessment, Mitigation, and Analytics
Capital Expenditure for 2018 – Authorized versus Recorded
(2018 Nominal $000, Total Company)



[18] Refer to WP SCE-07, Vol.1 Authorized vs Recorded.